US Army Corps of Engineers ®
Portland District

Salmon Recovery through John Day Reservoir

John Day Drawdown Phase I Study

Engineering Technical Appendix Irrigation Section






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SECTION 1. Introduction

This technical appendix section documents the results of the irrigation evaluation for the John Day Drawdown Phase I Study. This Phase I Study is a reconnaissance-level evaluation of the potential consequences and benefits of the proposed drawdown of the John Day Reservoir. This technical appendix section supplements the main report, which describes more fully the alternatives, purpose, scope, objectives, assumptions, and constraints of the study.

SECTION 2. Background of the Project

In 1991, the National Marine Fisheries Service (NMFS) proposed that Snake River wild sockeye, spring/summer chinook, and fall chinook salmon be granted "endangered" or "threatened" status under provisions of the Endangered Species Act. Natural resource agencies believe that the drawdown of the 76-mile John Day Reservoir may provide substantial improvements in migration and rearing conditions for juveniles by increasing river velocity, reducing water temperature and dissolved gas, and restoring riverine habitat. It is also speculated that drawdown may improve spawning conditions for adult fall chinook by restoring spawning habitat and the natural flow regimes needed for successful incubation and emergence.

As a result, the NMFS Reasonable and Prudent Alternative Action #5 of its' Biological Opinion on Operation of the Federal Columbia River Power System (FCRPS), and subsequent reports recommended that USACE investigate the feasibility of lowering John Day Reservoir. In compliance with appropriation conditions, only two alternatives were to be evaluated: reduction of the current water surface elevation 265 to the level of the spillway crest that would vary between elevations 217 and 230, or reduction to natural river level elevation 165. Both alternatives were proposed by NMFS. These two alternatives were then expanded to consider each alternative with 500,000 acre-feet of flood storage and without such storage. Flood storage and hydropower are the current approved authorizations for the John Day project.

SECTION 3. Description of the Study Area

The Columbia River originates in Canada and flows for 300 miles through eastern Washington to Oregon and continues west to the Pacific Ocean, as shown in Figure 1. The adjoining region is mostly open country, with widely scattered population centers. The climate of the region is semiarid. Agriculture, open space, and large farms are prevalent. Lands adjacent to the reservoir are used to grow grains and other crops. The reach of the Columbia River under consideration in this report extends from John Day Lock and Dam at river mile (RM) 215.6, to McNary Lock and Dam RM 291. The body of water impounded by John Day Dam, Lake Umatilla, is referred to as the John Day Reservoir throughout this report. The John Day is the second longest reservoir on the Columbia River, extending 76 miles upstream to McNary Dam.

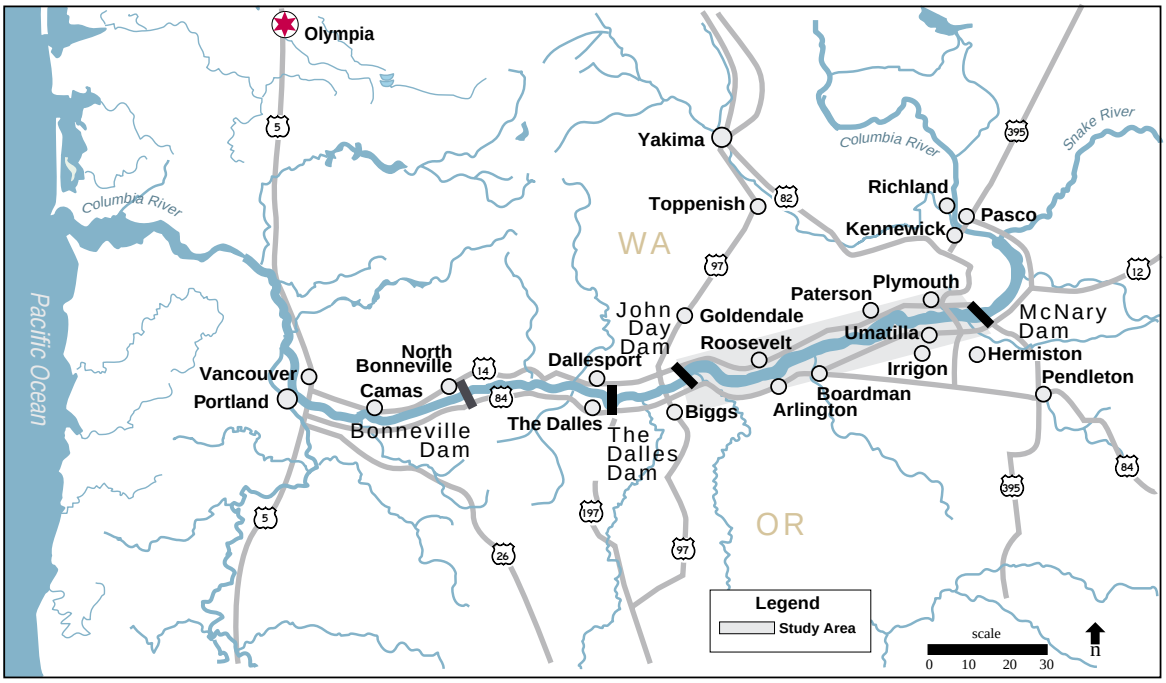


Figure 1. John Day Drawdown Phase 1 Study Area

John Day Dam and Reservoir are part of the Columbia-Snake Inland Waterway. This shallow-draft navigation channel extends 465 miles from the Pacific Ocean at the mouth of the Columbia River to Lewiston, Idaho. The entire channel consists of three segments. The first is the 40-foot-deep water channel for ocean-going vessels that extends for 106 miles from the ocean to Vancouver, Washington. The second is a shallow-draft barge channel that extends from Vancouver to The Dalles, Oregon. Although this section is authorized for dredging to a depth of 27 feet, it is currently maintained at 17 feet. The third section of the channel is authorized and maintained at a depth of 14 feet and extends from The Dalles to Lewiston. In addition to the main navigation channel, channels are dredged to numerous ports and harbors along the river.

The middle Columbia River area is served by a well-developed regional transportation system consisting of highways, railroads, and navigation channels. Railroads and highways parallel the northern and southern shores of the reservoir. Interstate 84 (I-84), a divided multilane highway, runs parallel on the south shore with the Columbia River from Portland, Oregon, to points east. Washington State Route 14 (SR-14) also parallels the Columbia River from Vancouver to McNary Dam on the north shore. Umatilla Bridge at RM 290.5, downstream from McNary Dam, is the only highway bridge linking Oregon and Washington across the Columbia River in the John Day Reservoir.

The study area includes lands directly adjacent to the reservoir as well as those directly and indirectly influenced by the hydrology of the reservoir (e.g., irrigated lands). It includes the reservoir behind the John Day Dam, and adjoining backwaters, embayments, pools, and rivers.

SECTION 4. Alternatives

The Phase 1 Study includes a preliminary evaluation of the impacts of the drawdown scenarios relative to the "without project condition," which is defined as the condition that would prevail into the future in the absence of any new federal action at John Day. The four alternatives are summarized below. One of the most important constraints on the alternatives is the requirement to pass fish for river flows up to the 10-year flood flow of 515,000 cfs. Under the four alternatives, John Day Reservoir would be drawn down at a rate of one foot per day. For greater detail, please refer to the main report, *John Day Drawdown Phase 1 Study*, and *John Day Drawdown Phase 1 Study, Engineering Technical Appendix, Structural Alternatives Section*.

4.1 Spillway Drawdown without Flood Control (Alternative 1)

The first drawdown alternative is based on requirements for improved downstream fish passage conditions during both low and flood flow conditions on the Columbia River. The existing 20-bay spillway will be operated differently from current operations, but without any structural modifications. All project inflows will be directly passed through the dam spillway with the spillway gates fully opened in free overflow condition, resulting in a pool elevation that will vary from elevation 217 to 230. Impacts downstream from John Day Dam were not studied.

4.2 Spillway Drawdown with Flood Control (Alternative 2)

The second study alternative is based on requirements for improved downstream fish passage conditions during low flow periods, while maintaining authorized flood control for the John Day Project. The existing 20-bay spillway will be operated differently from current operations, but without any structural modifications. During low flow periods, project inflows will be directly passed through the dam spillway with the spillway gates set in fully open, free overflow condition. During a flood event, however, the spillway gates will be controlled to reduce downstream flood flows based on using 500,000 acre-feet of allocated project storage space. Ponding will occur upstream from the dam. Impacts downstream from John Day Dam were not studied.

4.3 Natural River Drawdown without Flood Control (Alternative 3)

The third study alternative is based on a natural river drawdown for fish passage "without flood control" condition. Natural river conditions pertain to an opening at the John Day Dam that permits acceptable upstream fish passage conditions. The size of the total dam opening must conform to two criteria based on an invert elevation at the dam of 135. The first criterion is that the opening must be sufficiently large to meet maximum allowable stream velocity criteria for sustained swim speed for the weakest salmon species, which is estimated to be 10 feet per second (fps). The second criterion is that fish passage for this opening must correspond to the 10-year annual flood peak (515,000 cfs). This alternative will require extensive modifications to John Day Dam even beyond modification of the 1,228-foot long spillway structure. Impacts downstream from John Day Dam were not studied.

4.4 Natural River Drawdown with Flood Control (Alternative 4)

This fourth study alternative is based on natural river conditions for fish passage and includes the "with flood control" condition. It requires natural fish passage conditions for both upstream and downstream directions at the dam and includes a requirement for full authorized flood control. The calculated width of the total dam opening will correspond to that previously calculated for natural river conditions without flood control (Alternative 3). Impacts downstream from John Day Dam were not studied.

SECTION 5. Existing Information

Twelve irrigation pump stations have been identified along the Washington side of the reservoir, and 18 irrigation pump stations along the Oregon side of the reservoir. Existing information on each of the stations is shown in Table 1 (Oregon) and Table 2 (Washington). There are approximately 180,000 acres of irrigated lands along the John Day pool. Existing pump stations in Washington pump approximately 575,000 gpm using approximately 92,200 hp to irrigate approximately 92,000 acres. Existing pump stations in Oregon pump approximately 700,000 gpm using approximately 50,000 hp to irrigate approximately 92,000 acres. Irrigation pump stations are shown on plates 1 through 6.

Table 1.
Existing Pump Stations in Oregon

Name	Location (RM)	Number of Pumps and Power (hp)	Volume per Pump (gpm)	Available Reports	Available Information	Current Intake Elev.	Impacted Pool Elev.
Boeing	252.8	12 @ 600 each 1 @ 400 1 @ 200	82,000 total	(a)	Vertical Turbine, Pier	Unknown	262
Taggares Farm	252.8	12 @ 1,250 each	144,000 total	(a)	Vertical Turbine, Pier	Unknown	262
Sullivan Farm	252.8	2@ 125 each	4,000 total	(b)	Vertical Turbine,	Unknown	262
Harris Farm (Trafton)	252.8	1 @ 50	800	(b)	None	Unknown	263.5
Boardman Rest Area (Westbound lanes)	265.4	1 @ 25 (estimated)	150	None	None	Unknown	260
Circle C Farm	267.8	2 @ 200 each	2 @ 2,100 ea 4,200 total	(a) & (b)	Vertical Turbine, Shore	263 u/s 260.7 d/s	263.5
Port of Morrow	270.6	5 @ 300 each 4@ 200 each	18,900 total	(b)	Vertical Turbine,	Unknown	260
Columbia Improvement District	271.4	6 @ 500 each	144,000 total	(b)	Vertical Turbine, Shore	Unknown	259
Potlatch Corporation	271.4	1 @ 300 3 @ 250 each 2 @ 150 each	1 @ 26,000 3 @ 23,000 ea 2 @ 13,750 ea (122,500 total)	(b)	Vertical Turbine, Shore	Unknown	257
Western Empire #2	271.5	5 @ 800 each	31,000 total	(a) & (b)	Vertical Turbine, Shore	255	260
Western Empire #1	280.7	5 @ 300 each	25,000 total	(b)	Vertical Turbine, Shore	Unknown	259
West Extension Irrigation District #2	280.7	1 @ 300 2 @ 100 each	12,200 total	(b)	Vertical Turbine, Shore	Unknown	259
Strebin Farms	285.2	4 @ 200 each	13,300 total	(a) & (b)	Centrifugal	251 d/s 257 u/s	262
Perkins Farms	287.3	5 @ 600 each 1 @ 700	6 @ 3,250 19,500 total	(a) & (b)	Vertical Turbine, Shore	251	263
C & B Livestock	287.3	2 @ 1,000 each 4 @ 800 each 1 @ 600 1 @ 300	33,200 total	(a) & (b)	Vertical Turbine, Shore	248	263
Leonard Farm (d)	0.4	2 @ 500 each 1 @ 200	8,100 total	(b)	Inlet Channel	Unknown	263
West Extension Irrigation District #1	0.4	3 @ 600 each	35,000 total	(b)	Vertical Turbine, Shore	Unknown	263
Umatilla High School Athletic Field	0.8	1 @ 25 (estimated)	200 (estimated)	None	None	Unknown	Unknown

Table 2.
Existing Pump Stations in Washington

Name	Location (RM)	Number of Pumps and Power (hp)	Volume per Pump (gpm)	Available Reports	Available Information	Current Intake Elev.	Impacted Pool Elev.
Goldendale Aluminum	216.9	6 @ 600 each	21,000 total	None	Shore	Unknown	Unknown
Harris Farms	240.8	2 @ 300 each	4,000 (estimated)	None	None	Unknown	Unknown
Mercer Ranches	261	1 @ 1,500 1 @ 1,250 1 @ 1,000 2 @ 800 each 3 @ 600 each	1 @ 8,000 1 @ 7,000 1 @ 5,500 1 @ 4,100 1 @ 4,000 3 @ 3,000 ea (37,100 total)	(b)	Vertical Turbine, Pier	262	262
100 Circles Farm	264	8 @ 1,500 each 2 @ 1,000 each	8 @ 10,000 ea 2 @ 6,500 ea (93,000 total)	(b)	Vertical Turbine, Pier	261	261
USFWS/Whitcomb Island	266.6	6 @ 410 (total)	5,000 total	(a)	Vertical Turbine, Pier	259	260.5
Sandpiper Farms	271.5	5 @ 7,500 (total)	45,000 total	(a)	Vertical Turbine, Pier	250.7	257
Milliman Farms	272.3	1 @ 30	250	(a)	Cent, shore	260	260
Sunheaven Farms	276.4	6 @ 12,000 (total)	66,000 total	(a)	Vertical Turbine, Shore	257	257.5
Stimson Lane	276.4	4 @ 1,500 each 5 @ 1,000 each 1 @ 800 6 @ 700 each 2 @ 250 each	4 @ 8,300 ea 5 @ 5,600 ea 1 @ 4,300 6 @ 3,700 ea 2 @ 1,300 ea (90,300 total)	(b)	Vertical Turbine, Shore	4 @ 250 14 @ 255 (sump)	260
South Slope Irrigation District	277	8 @ 4,400 (total)	36,000 total	(a)	Vertical Turbine, Shore	253	257.5
Berg Brothers	(277)	4,000 (estimated)	31,900 total	None	None	Unknown	Unknown
U & I/AgrilNorthwest	285.1	20 @ 22,000 (total)	145,000 total	(a)	Vertical Turbine, Pier	251	257

EXISTING REPORTS:

a Existing pump station information and proposed modifications for drawdown to minimum operating pool (MOP) included in "Washington Shore, Irrigation Pumping Stations Evaluations, Feb. 1993", prepared by Bovay Northwest, Inc.

b Existing pump station information and proposed modifications for drawdown to MOP included in "Effects of JDPD on Selected Pumping Stations In Washington, Aug. 1991", prepared by PACAM Engineering and IRZ Consulting.

c "Feasibility of Irrigation Canal Along the John Day Pool on Washington", Mar. 1993, prepared by PACAM Engineering and IRZ Consulting.

d Preliminary design information developed during MOP Study, Apr. 1994, Appendix B, Technical Report

Phase I of the study will use existing information as detailed in the John Day Drawdown Phase I, Scope of Study. Irrigation impacts and modifications were determined using information from the following reports:

- "Effects of JDPD on Irrigated Agriculture in Oregon", August 1991, prepared by PACAM Engineering and IRZ Consulting.
- "Washington Shore, Irrigation Pumping Stations Evaluations", February 1993, prepared by Bovay Northwest, Inc.
- "Feasibility of Irrigation Canal Along the Columbia River in Oregon", November 1992, prepared by IRZ Consulting and PACAM Engineering.
- "Feasibility of Irrigation Canal Along the John Day Pool on Washington", March 1993, prepared by PACAM Engineering and IRZ Consulting.
- "Effects of JDPD on Selected Pumping Stations In Washington", August 1991, prepared by PACAM Engineering and IRZ Consulting.
- Appendix B, Technical Report, John Day Reservoir, Minimum Operating Pool, prepared by Portland District, U.S. Army Corps of Engineers, April 1994.

SECTION 6. Impacts

Under each alternative, all 30 irrigation pump stations will be impacted. These impacts will include the following:

- Excessive head loss from lowered pool level.
- Intakes no longer functional at the new water level.
- Increased pumping costs due to higher lift and additional pumps.
- Increased operations and maintenance (O&M) due to higher sediment loads from lower pool levels.
- Requirement for interim pumping during construction of pump station modifications to reduce impacts to multi-year irrigated crops. This cost would be evaluated under Phase II.

6.1 Pump Station Modifications

Pump station modifications will require one or both of the following modifications:

- New low lift pumps, and intakes with fish screens, to deliver water to existing pump stations.
- New intake pipes (with fish screens) to the lowered pool to deliver water to existing pump stations.

All pump stations will require new intakes with fish screens, and most will require new low lift pumps, as shown in Table 3.

Table 3. Pump Station Modifications		
Drawdown Alternatives	**New Low Lift Pump Stations**	**New Intake Pipes w/Fish Screens**
Nos. 1 and 2	23	30
Nos. 3 and 4	24	30

6.1.1 Proposed Pump Station Modifications (Oregon).

Proposed modifications at each of the pump stations in Oregon are listed below:

6.1.1.1 Boeing/Taggares (OR), RM 252.8.

The Boeing station has 14 pumps totaling approximately 7,800 horsepower (hp), and the Taggares station has 12 pumps totaling approximately 15,000 hp. The pumps are designed to pump approximately 226,000 gpm to irrigate approximately 25,000 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Twelve low lift pumps, each 900 hp, 210 Total Dynamic Head in feet (TDH), located on the Columbia River (near Interstate 84). The intake pipes (72-inch diameters) would extend 1,000 LF into the river. The discharge pipes (2 @ 60-inch diameters) would convey water approximately 5,000 LF to the existing pump stations.
- **Alternatives 3 and 4 - Natural River Drawdown.** Twelve low lift pumps, each 1,000 hp, 235 TDH, located on the Columbia River (near Interstate 84). The intake pipes (72-inch diameters) would extend 1,700 LF into the river. The discharge pipes (2 @ 60-inch diameters) would convey water approximately 5,000 LF to the existing pump stations.

6.1.1.2 Sullivan Farm (OR), RM 252.8.

This station has two pumps totaling approximately 250 hp. The pumps are designed to pump approximately 4,000 gpm to irrigate approximately 700 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 200 hp, 230 TDH, located on the Columbia River (near Interstate 84). The intake pipe (24-inch diameter) would extend 1,000 LF into the river. The discharge pipe (18-inch diameter) would convey water approximately 5,000 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 250 hp, 250 TDH, located on the Columbia River (near Interstate 84). The intake pipe (24-inch diameter) would extend 1,700 LF into the river. The discharge pipe (18-inch diameter) would convey water approximately 5,000 LF to the existing pump station.

6.1.1.3 Harris Farm (OR), RM 252.8.

This station has one pump, approximately 50 hp. The pump is designed to pump approximately 800 gpm to irrigate approximately 100 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 50 hp, 215 TDH, located on the Columbia River (near Interstate 84). The intake pipe (24-inch diameter) would extend 1,000 LF into the river. The discharge pipe (16-inch diameter) would convey water approximately 8,000 LF to the existing pump station.

- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 50 hp, 235 TDH, located on the Columbia River (near Interstate 84). The intake pipe (24-inch diameter) would extend 1,700 LF into the river. The discharge pipe (16-inch diameter) would convey water approximately 8,000 LF to the existing pump station.

6.1.1.4 Boardman Rest Area (OR), RM 265.4.

This station has 1 pump, approximately 25 hp (estimated). The pump is designed to pump approximately 150 gpm to irrigate approximately 10 acres (estimated).

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 25 hp, 70 TDH, located on the river shoreline. The intake pipe (12-inch diameter) would extend 1,800 LF into the river. The discharge pipe (8-inch diameter) would convey water approximately 900 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 25 hp, 70 TDH, located on the river shoreline. The intake pipe (12-inch diameter) would extend 1,800 LF into the river. The discharge pipe (8-inch diameter) would convey water approximately 900 LF to the existing pump station.

6.1.1.5 Circle C Farm (OR), RM 267.8.

This station has two pumps totaling approximately 400 hp. The pumps are designed to pump approximately 4,200 gpm to irrigate approximately 550 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 75 hp, 70 TDH, located on the river shoreline. The intake pipe (24-inch diameter) would extend 3,400 LF into the river. The discharge pipe (18-inch diameter) would convey water approximately 900 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 75 hp, 70 TDH, located on the river shoreline. The intake pipe (24-inch diameter) would extend 3,400 LF into the river. The discharge pipe (18-inch diameter) would convey water approximately 900 LF to the existing pump station.

6.1.1.6 Port of Morrow (OR), RM 270.6.

This station has 9 pumps totaling approximately 2,300 hp. The pumps are designed to pump approximately 18,900 gpm to irrigate approximately 2,000 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown**. One low lift pump, 300 hp, 70 TDH, located on the river shoreline. The intake pipe (42-inch diameter) would extend 1,100 LF into the river. The discharge pipe (36-inch diameter) would convey water approximately 3,500 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 300 hp, 70 TDH, located on the river shoreline. The intake pipe (42-inch diameter) would extend 1,100 LF into the river. The discharge pipe (36-inch diameter) would convey water approximately 3,500 LF to the existing pump station.

6.1.1.7 Columbia Improvement District (OR), RM 271.4.

This is a low-lift pump station which lifts water from the river into a pipeline feeding a booster pump station on shore. The low-lift station has 6 pumps totaling approximately 3,000

hp. The pumps are designed to pump approximately 144,000 gpm to irrigate approximately 17,500 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** New intake pipes (60-inch diameters) would extend 1,000 LF into the river.
- **Alternatives 3 and 4 - Natural River Drawdown.** New intake pipes (60-inch diameters) would extend 1,000 LF into the river.

6.1.1.8 Potlatch Corporation (OR), RM 271.4.

This is a low-lift pump station that lifts water from the river into a relift sump located approximately 200 feet away. The low-lift station has six pumps totaling approximately 1,350 hp. The pumps are designed to pump approximately 122,500 gpm to irrigate approximately 10,500 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Six low lift pumps (1 @ 350 hp, 3 @ 300 hp, and 2 @ 200 hp), 60 TDH, located on the river shoreline. The intake pipes (48-inch diameters) would extend 1,000 LF into the river. The discharge pipes (42-inch diameters) would convey water approximately 200 LF to the relift sump.
- **Alternatives 3 and 4 - Natural River Drawdown.** Six low lift pumps (1 @ 360 hp, 3 @ 300 hp, and 2 @ 200 hp), 65 TDH, located on the river shoreline. The intake pipes (48-inch diameters) would extend 500 LF into the river. The discharge pipes (42-inch diameters) would convey water approximately 700 LF to the relift sump.

6.1.1.9 Western Empire No. 2 (OR), RM 271.5.

This station has five pumps totaling approximately 4,000 hp. The pumps are designed to pump approximately 31,000 gpm to irrigate approximately 2,400 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Two low lift pumps, 200 hp, 60 TDH, located on the river shoreline. The intake pipe (48-inch diameter) would extend 1,000 LF into the river. The discharge pipe (42-inch diameter) would convey water approximately 300 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** Two low lift pumps, 200 hp, 60 TDH, located on the river shoreline. The intake pipe (48-inch diameter) would extend 500 LF into the river. The discharge pipe (42-inch diameter) would convey water approximately 800 LF to the existing pump station.

6.1.1.10 Western Empire No. 1 (OR), RM 280.7.

This station has five pumps totaling approximately 1,500 hp. The pumps are designed to pump approximately 25,000 gpm to irrigate approximately 2,100 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** New intake pipe (32-inch diameter) would extend approximately 400 LF into the river.
- **Alternatives 3 and 4 - Natural River Drawdown.** New intake pipe (32-inch diameter) would extend approximately 400 LF into the river.

6.1.1.11 West Extension Irrigation District No. 2 (OR), RM 280.7.

This station has three pumps totaling approximately 500 hp. The pumps are designed to pump approximately 12,200 gpm to irrigate approximately 1,100 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** New intake pipe (24-inch diameter) would extend 400 LF into the river.
- **Alternatives 3 and 4 - Natural River Drawdown.** New intake pipe (24-inch diameter) would extend 400 LF into the river.

6.1.1.12 Strebin Farms (OR), RM 285.2.

This station has four pumps totaling approximately 800 hp. The pumps are designed to pump approximately 13,300 gpm to irrigate approximately 1,530 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 150 hp, 45 TDH, located on the river shoreline. The intake pipe (36-inch diameter) would extend 1,600 LF into the river. The discharge pipe (30-inch diameter) would convey water approximately 200 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 150 hp, 45 TDH, located on the river shoreline. The intake pipe (36-inch diameter) would extend 1,600 LF into the river. The discharge pipe (30-inch diameter) would convey water approximately 200 LF to the existing pump station.

6.1.1.13 Perkins Farms (OR), RM 287.3.

This station has six pumps totaling approximately 3,700 hp. The pumps are designed to pump approximately 19,500 gpm to irrigate approximately 1,700 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** New intake pipe (42-inch diameter) would extend 1,600 LF into the river.
- **Alternatives 3 and 4 - Natural River Drawdown.** New intake pipe (42-inch diameter) would extend 1,600 LF into the river.

6.1.1.14 C&B Livestock (OR), RM 287.3.

This station has eight pumps totaling approximately 5,100 hp. The pumps are designed to pump approximately 33,200 gpm to irrigate approximately 2,900 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** New intake pipe (48-inch diameter) would extend 1,600 LF into the river.
- **Alternatives 3 and 4 - Natural River Drawdown.** New intake pipe (48-inch diameter) would extend 1,600 LF into the river.

6.1.1.15 Leonard Farm (OR), RM 0.4 (Umatilla River).

This station has 3 pumps totaling approximately 1,200 hp. The pumps are designed to pump approximately 8,100 gpm to irrigate approximately 2,000 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 100 hp, 55 TDH, located on the Columbia River. The intake pipe (30-inch diameter) would extend 800 LF

into the river. The discharge pipe (24-inch diameter) would convey water approximately 5,000 LF to the existing pump station.

- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 100 hp, 55 TDH, located on the Columbia River. The intake pipe (30-inch diameter) would extend 800 LF into the river. The discharge pipe (24-inch diameter) would convey water approximately 5,000 LF to the existing pump station.

6.1.1.16 West Extension Irrigation District No. 1 (OR), RM 0.4 (Umatilla River).

This station has three pumps totaling approximately 1,800 hp. The pumps are designed to pump approximately 35,000 gpm to irrigate approximately 8,600 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Two low lift pumps, each 200 hp, 40 TDH, located on the Columbia River. The intake pipe (48-inch diameter) would extend 800 LF into the river. The discharge pipe (42-inch diameter) would convey water approximately 5,000 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** Two low lift pumps, each 200 hp, 40 TDH, located on the Columbia River. The intake pipe (48-inch diameter) would extend 800 LF into the river. The discharge pipe (42-inch diameter) would convey water approximately 5,000 LF to the existing pump station.

6.1.1.17 Umatilla High School, Athletic Field (OR), RM 0.8 (Umatilla River).

This station has one pump, approximately 25 hp (estimated). The pump is designed to pump approximately 200 gpm (estimated) to irrigate approximately 15 acres (estimated).

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 25 hp, 35 TDH, located on the Columbia River. The intake pipe (24-inch diameter) would extend 800 LF into the river. The discharge pipe (12-inch diameter) would convey water approximately 5,000 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 25 hp, 35 TDH, located on the Columbia River. The intake pipe (24-inch diameter) would extend 800 LF into the river. The discharge pipe (12-inch diameter) would convey water approximately 5,000 LF to the existing pump station.

6.1.2 Proposed Pump Station Modifications (Washington)

Proposed modifications at each of the pump stations in Washington are listed below.

6.1.2.1 Goldendale Aluminum (WA), RM 216.98.

This station has six pumps totaling approximately 3,600 hp. The pumps are designed to pump approximately 21,000 gpm.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 500 hp, 100 TDH, located on the river shoreline. The intake pipe (48-inch diameter) would extend 1,000 LF into the river. The discharge pipe (42-inch diameter) would convey water approximately 700 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 750 hp, 165 TDH, located on the river shoreline. The intake pipe (48-inch diameter) would extend

1,200 LF into the river. The discharge pipe (42-inch diameter) would convey water approximately 700 LF to the existing pump station.

6.1.2.2 Harris Farms (WA), RM 240.8.

This station has two pumps totaling approximately 600 hp. The pumps are designed to pump approximately 4,000 gpm (estimated) to irrigate approximately 500 acres (estimated).

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Existing pumps will be replaced with two new pumps, each 400 hp, 60 TDH. The intake pipe (30-inch diameter) would extend 1,200 LF into the river.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 100 hp, 100 TDH, located on the river shoreline. The intake pipe (30-inch diameter) would extend 400 LF into the river. The discharge pipe (24-inch diameter) would convey water approximately 800 LF to the existing pump station.

6.1.2.3 Mercer Ranches (WA), RM 261.

This station has eight pumps totaling approximately 7,150 hp. The pumps area designed to pump approximately 37,100 gpm to irrigate approximately 3,500 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Two low lift pumps, each 500 hp, 115 TDH, located on the river shoreline. The intake pipes (48-inch diameters) would extend 800 LF into the river. The discharge pipes (2 @ 42-inch diameters) would convey water approximately 9,000 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** Two low lift pumps, each 550 hp, 125 TDH, located on the river shoreline. The intake pipes (48-inch diameters) would extend 700 LF into the river. The discharge pipes (2 @ 42-inch diameters) would convey water approximately 9,000 LF to the existing pump station.

6.1.2.4 100 Circles Farm (WA), RM 264.

This station has 10 pumps totaling approximately 14,000 hp. The pumps are designed to pump approximately 93,000 gpm to irrigate approximately 10,000 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Two low lift pumps, each 750 hp, 75 TDH, located on the river shoreline. The intake pipes (60-inch diameters) would extend 1,100 LF into the river. The discharge pipes (2 @ 54-inch diameters) would convey water approximately 4,200 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** Two low lift pumps, each 850 hp, 85 TDH, located on the river shoreline. The intake pipes (60-inch diameters) would extend 1,100 LF into the river. The discharge pipes (2 @ 54-inch diameters) would convey water approximately 4,200 LF to the existing pump station.

6.1.2.5 USFS/Whitcomb Island (WA), RM 266..

This station has six pumps totaling approximately 410 hp. The pumps are designed to pump approximately 5,000 gpm to irrigate approximately 700 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 75 hp, 60 TDH, located on the river shoreline. The intake pipe (30-inch diameter) would extend 500 LF

into the river. The discharge pipe (24-inch diameter) would convey water approximately 700 LF to the existing pump station.

- **Alternatives 3 and 4 - Natural River Drawdown**. One low lift pump, 100 hp, 70 TDH, located on the river shoreline. The intake pipe (30-inch diameter) would extend 500 LF into the river. The discharge pipe (24-inch diameter) would convey water approximately 700 LF to the existing pump station.

6.1.2.6 Sandpiper Farms (WA), RM 271.5.

This station has five pumps totaling approximately 7,500 hp. The pumps are designed to pump approximately 45,000 gpm to irrigate approximately 5,100 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Two low lift pumps, each 250 hp, 50 TDH, located on the river shoreline. The intake pipes (48-inch diameters) would extend 1,500 LF into the river. The discharge pipes (2 @ 42-inch diameters) would convey water approximately 200 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** Two low lift pumps, each 250 hp, 50 TDH, located on the river shoreline. The intake pipes (48-inch diameters) would extend 1,500 LF into the river. The discharge pipes (2 @ 42-inch diameters) would convey water approximately 200 LF to the existing pump station.

6.1.2.7 Milliman Farms (WA), RM 272.3.

This station has one pump, 30 hp. The pump is designed to pump approximately 250 gpm to irrigate approximately 50 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** One low lift pump, 25 hp, 55 TDH, located on the river shoreline. The intake pipe (24-inch diameter) would extend 500 LF into the river. The discharge pipe (12-inch diameter) would convey water approximately 200 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** One low lift pump, 25 hp, 55 TDH, located on the river shoreline. The intake pipe (24-inch diameter) would extend 500 LF into the river. The discharge pipe (12-inch diameter) would convey water approximately 200 LF to the existing pump station.

6.1.2.8 Sunheaven Farms (WA), RM 276.4.

This station has six pumps totaling approximately 12,000 hp. The pumps are designed to pump approximately 66,000 gpm to irrigate approximately 9,950 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown..** Two low lift pumps, each 350 hp, 50 TDH, located on the river shoreline. The intake pipes (48-inch diameters) would extend 1,900 LF into the river. The discharge pipes (2 @ 42-inch diameters) would convey water approximately 1,000 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** Two low lift pumps, each 350 hp, 50 TDH, located on the river shoreline. The intake pipes (48-inch diameters) would extend 1,900 LF into the river. The discharge pipes (2 @ 42-inch diameters) would convey water approximately 1,000 LF to the existing pump station.

6.1.2.9 Stimson Lane (WA), RM 276.4.

This station has 18 pumps totaling approximately 16,500 hp. The pumps are designed to pump approximately 90,300 gpm to irrigate approximately 9,100 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown.** Two low lift pumps, each 500 hp, 50 TDH, located on the river shoreline. The intake pipes (60-inch diameters) would extend 1,900 LF into the river. The discharge pipes (2 @ 54-inch diameters) would convey water approximately 1,000 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown.** Two low lift pumps, each 500 hp, 50 TDH, located on the river shoreline. The intake pipes (60-inch diameters) would extend 1,900 LF into the river. The discharge pipes (2 @ 54-inch diameters) would convey water approximately 1,000 LF to the existing pump station.

6.1.2.10 South Slope Irrigation District (WA), RM 277.

This station has eight pumps totaling approximately 4,400 hp. The pumps are designed to pump approximately 36,000 gpm to irrigate approximately 4,800 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown**. Two low lift pumps, each 250 hp, 55 TDH, located on the river shoreline. The intake pipe (48-inch diameter) would extend 1,800 LF into the river. The discharge pipes (2 @ 36-inch diameters) would convey water approximately 1,000 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown**. Two low lift pumps, each 250 hp, 55 TDH, located on the river shoreline. The intake pipe (48-inch diameter) would extend 1,800 LF into the river. The discharge pipes (2 @ 36-inch diameters) would convey water approximately 1,000 LF to the existing pump station.

6.1.2.11 Berg Brothers (WA), RM 277.

The pumps at this station are designed to pump approximately 31,900 gpm to irrigate approximately 4,000 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown**. Two low lift pumps, each 250 hp, 55 TDH, located on the river shoreline. The intake pipe (48-inch diameter) would extend 1,800 LF into the river. The discharge pipes (2 @ 36-inch diameters) would convey water approximately 1,000 LF to the existing pump station.
- **Alternatives 3 and 4 - Natural River Drawdown**. Two low lift pumps, each 250 hp, 55 TDH, located on the river shoreline. The intake pipe (48-inch diameter) would extend 1,800 LF into the river. The discharge pipes (2 @ 36-inch diameters) would convey water approximately 1,000 LF to the existing pump station.

6.1.2.12 U&I/Agri-Northwest (WA), RM 285.1.

This station has 20 pumps totaling approximately 22,000 hp. The pumps are designed to pump approximately 145,000 gpm to irrigate approximately 21,000 acres.

- **Alternatives 1 and 2 - Spillway Crest Drawdown**. Six (6) low lift pumps, each 250 hp, 40 TDH, located on the river shoreline. The intake pipes (60-inch diameters) would extend 600 LF into the river. The discharge pipes (2 @ 48-inch diameters) would convey water approximately 200 LF to the existing pump station.

- **Alternatives 3 and 4 - Natural River Drawdown**. Six (6) low lift pumps, each 250 hp, 40 TDH, located on the river shoreline. The intake pipes (60-inch diameters) would extend 600 LF into the river. The discharge pipes (2 @ 48-inch diameters) would convey water approximately 200 LF to the existing pump station.

6.1.3 Pump Station Quantities and Costs

Pump station quantities and costs were based on the following. See figure 2 for sketch layout.

- Low lift pumps. Pumps to deliver water from lowered pool to existing pump station. Pumps vary between 25 hp and 1000 hp.
- Fish screens (twin wedge-wire). Cylindrical steel wedge-wire screens located on intake pipes (diameter of screen varies).
- Requirements for cofferdam and dewatering. Cofferdam and dewatering requirements to install discharge pipe from low lift pumps to existing pump station.
- Intake pipe or pipes. Steel pipe (diameter of pipe varies) to deliver water to low lift pump station or for those stations requiring intake pipe extensions.
- Pump caisson and manifold pipe. Steel pipe (diameter of pipe varies) for low lift and existing pump stations. Each caisson would contain one pump.
- Discharge pipe or pipes. Steel pipe (diameter of pipe varies) from low lift pump to existing pump station.
- Inlet structure at existing pump station. Modification of existing inlet structure (construction of weir box) at existing pump station.
- Electrical and mechanical hookups for low lift pumps.
- Electrical transmission line and transformers for low lift pumps.
- Access road to low lift pump station.
- Land acquisition for low lift pump station and discharge lines.

6.2 Operation and Maintenance

An increase in O&M will be required for the following:

- Operation of the new low lift pump stations
- Operation of the existing pumps at a higher pumping head
- Maintenance associated with the intake structure and fish screens (removal of sediment from drawdown)

Estimated costs for additional O&M, including increase in power costs, are shown in Table 4.

6.3 Summary: Irrigation Pump Stations

Total estimated costs and additional O&M are shown in Table 4.

Table 4.
Estimated Costs for Irrigation Pump Stations

Drawdown Alternatives	Description	Total Estimated Costs ($K)	Additional O&M ($K)
Nos. 1 & 2	Spillway Crest Drawdown	$236,921	$4.8 to 9.1
Nos. 3 & 4	Natural River Drawdown	$238,694	$5.5 to 10

SECTION 7. Irrigation Canals

A canal option is included as an alternative for providing water to irrigators impacted by drawdown. Proposed Oregon and Washington routes and system design information was obtained from the "Feasibility of Irrigation Canal Along the Columbia River in Oregon", (November 1992) and from "Feasibility of Irrigation Canal Along the John Day Pool on Washington", (March 1993).

7.1 Irrigation Canals in Washington

A major pump station would lift water from the McNary pool to a canal along the Washington shore for approximately 42 miles and deliver water as far west as Harris Farms (located at RM 240.8). For estimating purposes, a design capacity of 1,639 cfs was used from the report mentioned above (1,639 cfs was selected based on existing pump station capacities and accounts for evaporation losses and unknowns). A pump station would also be required to lift water from The Dalles pool to a canal extending along the Washington shore for approximately 1.5 miles and deliver water to Goldendale Aluminum (located at RM 216.9). Existing pump stations would be relocated to the canals.

7.2 Irrigation Canal in Oregon

A major pump station would lift water from the McNary pool to a canal extending along the Oregon shore for approximately 37 miles and deliver water as far west as Willow Creek (located near 252.8). For estimating purposes, a design capacity of 1,988 cfs was used from the report cited above (1,988 cfs was selected based on existing pump station capacities and accounts for evaporation losses and unknowns). Existing pump stations would be relocated to the canal.

Using information from the reports referenced above, preliminary canal design features and quantities were determined. Canal design features are listed in the table, below. See Figure 3 for the Oregon Canal route and Figure 4 for the Washington Canal route. See Figures 5 through 9 for sketch layouts.

Table 5. Canal Design Features
• Pumps are required to pump water from the Columbia River pump stations (McNary and The Dalles pools) into the canals. The Oregon Canal Pump Station would consist of 20 pumps, each 1500 hp and 44,600 gpm. The Washington Canal from McNary pool would consist of 16 pumps, each 1500 hp and 46,000 gpm; and The Dalles pool would consist of 4 pumps, each 400 hp and 5,300 gpm.
• Fish screens (twin wedge-wire). Located on intake pipes to the Columbia River pump stations.
• Intake pipes. Steel pipe to deliver water to the Columbia River pump stations. For estimating purposes, one intake would be provided for two pumps.
• Pump caisson and manifold pipes. Steel pipe required for the Columbia River pump stations. Each caisson would contain one pump.
• Discharge pipeline to convey water from the Columbia River pump stations to the canals.
• Electrical and mechanical hookups for all pumps.
• Electrical transmission line and transformers to the Columbia River pump stations and to the relocated pump stations along the canals.
• Excavation and fill to form the canal section.
• Concrete lining (3-inch thickness) for the canals.
• Security fence along both sides of the canals, around the Columbia River pump stations, and around the relocated pump stations.
• Bridges required at road crossings (22-feet wide).
• Canal check structures required for each relocated pump station.
• Relocated irrigation pump stations (use existing pumps) including check and pressure relief valve assemblies.
• Regulating reservoirs.
• Automation and control systems for full automation of the Columbia River pump stations and pump stations along the canals.
• Restoration of original pump station sites to a more natural state.
• Siphon crossings of the Umatilla River, railroad, highways, creeks, Four Mile Canyon and Wood Gulch.
• Land acquisition for the Columbia River pump stations, canals, and relocated pump stations.

7.3 Operation and Maintenance

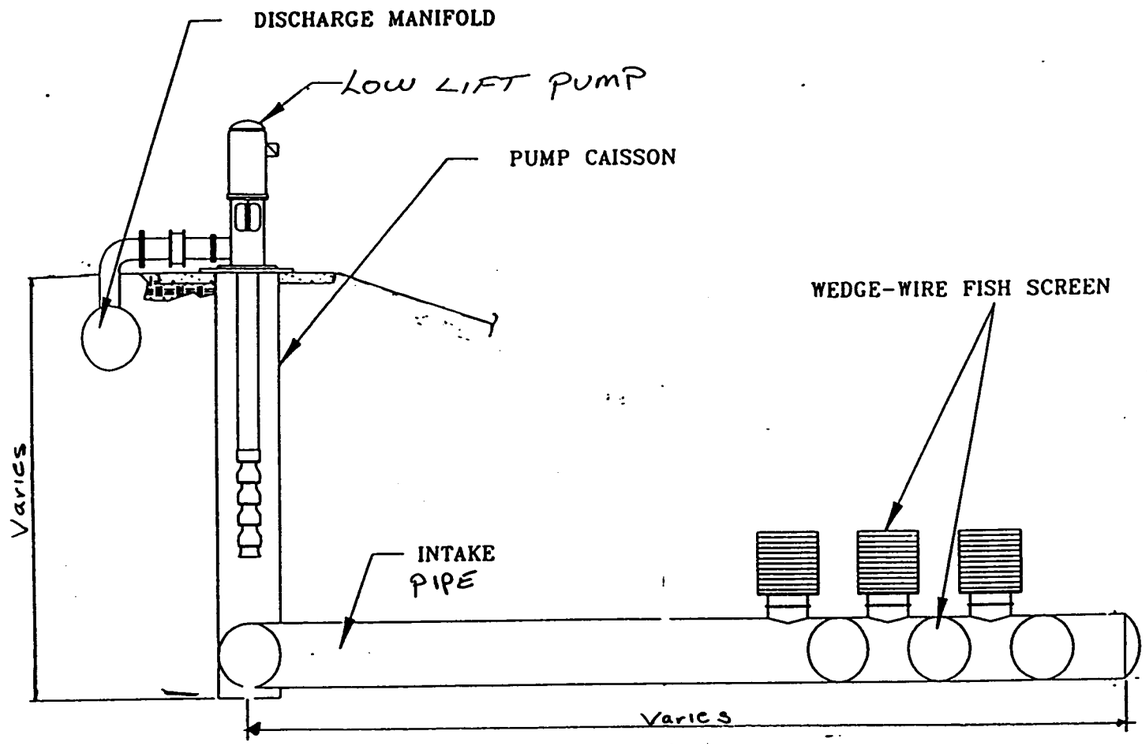
O&M will be required for both pump stations and canal alternatives. Estimated costs for O&M, including power, are shown in Table 6.

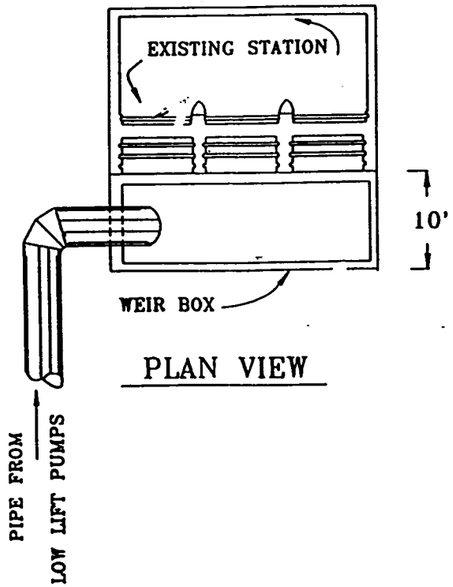
Table 6.
Estimated Costs for Canals

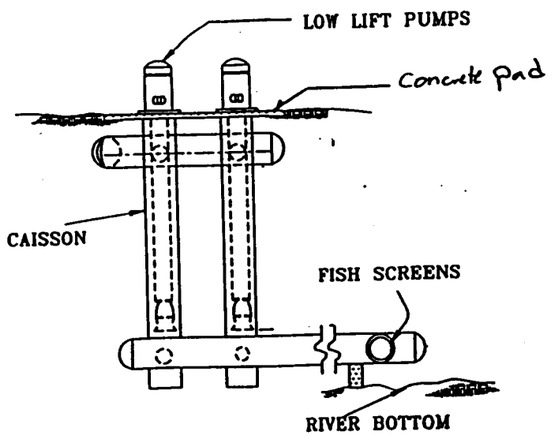
Description	Annual O&M (x1000)
Washington Canal	$4.5 to $10
Oregon Canal	$4.5 to $10
Total	**$9 to $20**

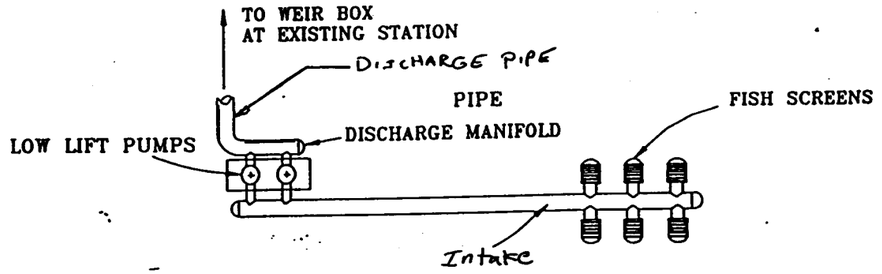
SECTION 8. Conclusions

The least cost alternative, and the one that would have the greatest impact, is the alternative that suggests modifications to the existing pump stations. The canal option would allow construction and initial operations of the system to be to be completed prior to any drawdown. To minimize impacts to irrigation as well as loss of irrigation crops (such as grapes and hybrid cottonwoods), pump station modifications should be completed prior to drawdown.









JOHN DAY DRAWDOWN PHASE I STUDY
Columbia River - Oregon / Washington

IRRIGATION PUMP STATIONS MODIFICATION LAYOUT - SKETCH

FIGURE 2

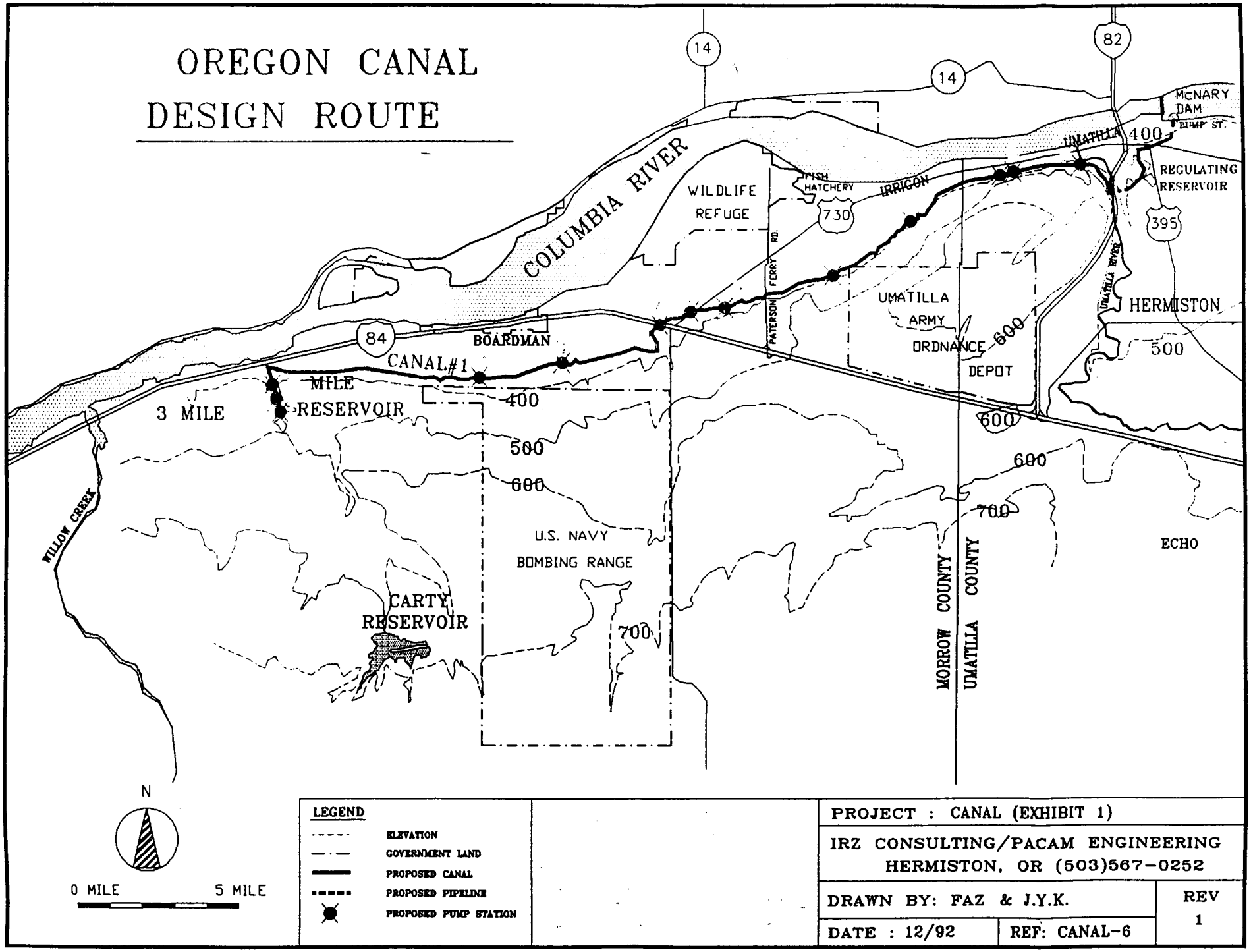

OREGON CANAL
DESIGN ROUTE
COLUMBIA RIVER
WILDLIFE
REFUGE
FISH
HATCHERY
IRRIGON
14
14
82
McNARY
DAM
PUMP ST.
UMATILLA
400
REGULATING
RESERVOIR
730
395
FERRY RD.
PATERSON
UMATILLA RIVER
UMATILLA
ARMY
ORDNANCE
DEPOT
HERMISTON
500
600
600
84
BOARDMAN
CANAL#1
MILE
3 MILE
RESERVOIR
400
500
600
600
700
WILLOW CREEK
U.S. NAVY
BOMBING RANGE
CARTY
RESERVOIR
700
MORROW COUNTY
UMATILLA COUNTY
ECHO
N
0 MILE
5 MILE
LEGEND
ELEVATION
GOVERNMENT LAND
PROPOSED CANAL
PROPOSED PIPELINE
PROPOSED PUMP STATION
PROJECT : CANAL (EXHIBIT 1)
IRZ CONSULTING/PACAM ENGINEERING
HERMISTON, OR (503)567-0252
DRAWN BY: FAZ & J.Y.K.
REV
1
DATE : 12/92
REF: CANAL-6

FIGURE 3

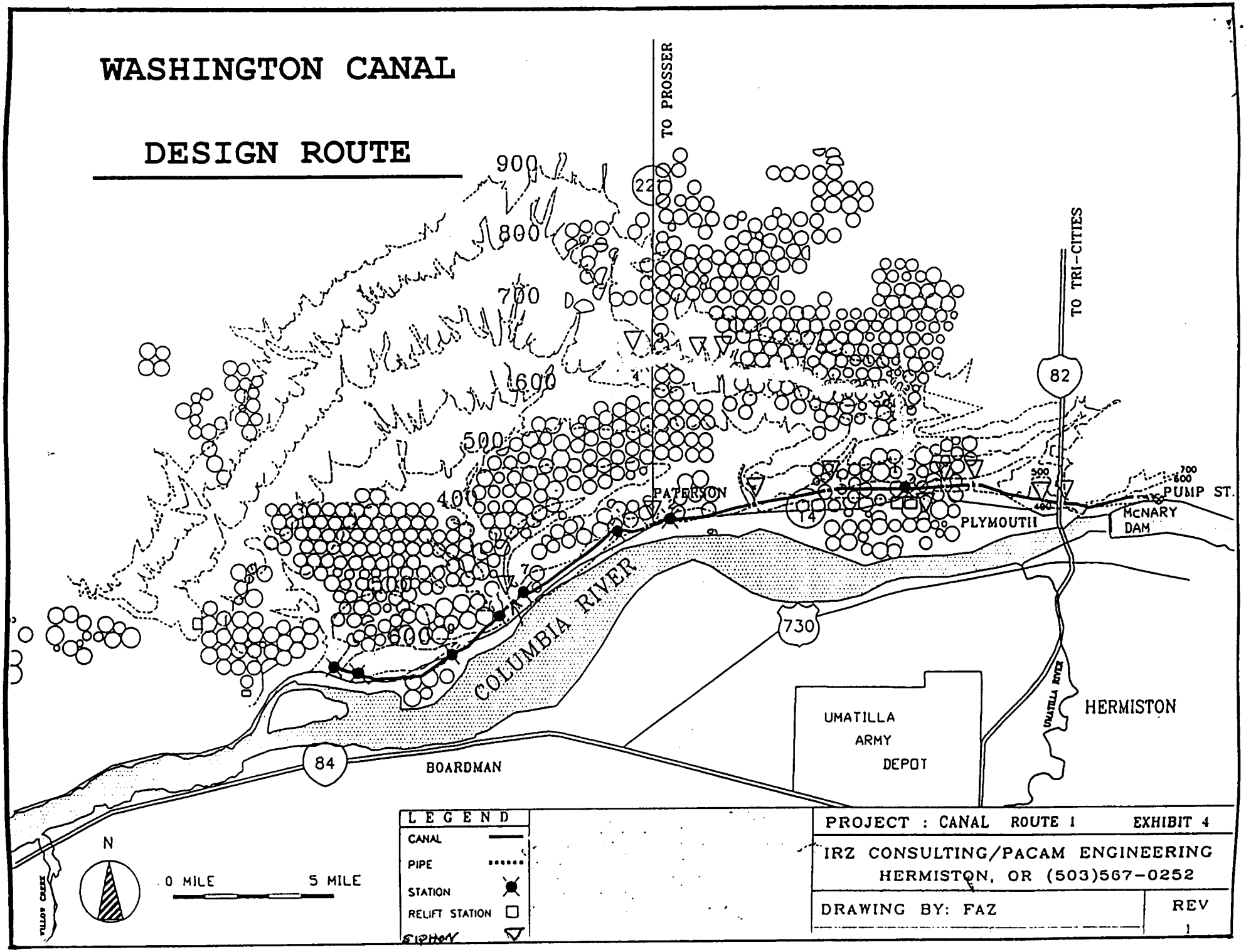
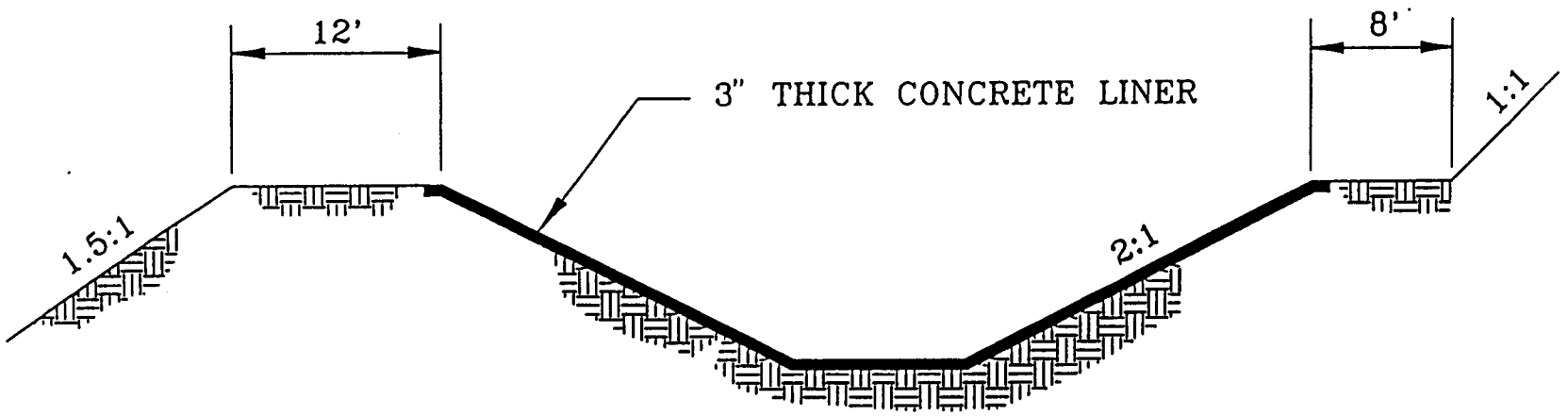

WASHINGTON CANAL
DESIGN ROUTE
TO PROSSER
TO TRI-CITIES
900
800
700
600
500
400
300
200
100
22
82
14
730
84
PATERSON
PLYMOUTH
PUMP ST.
McNARY DAM
COLUMBIA RIVER
UMATILLA ARMY DEPOT
UMATILLA RIVER
HERMISTON
BOARDMAN
LEGEND
CANAL
PIPE
STATION
RELIFT STATION
SIPHON
N
0 MILE
5 MILE
PROJECT : CANAL ROUTE 1
EXHIBIT 4
IRZ CONSULTING/PACAM ENGINEERING
HERMISTON, OR (503)567-0252
DRAWING BY: FAZ
REV
1

FIGURE 4



TYPICAL CANAL SECTION
EXHIBIT NO. 9

DATE: FEB. 1993	DRAWN BY: W.N.R.	REV. 1

FIGURE 5

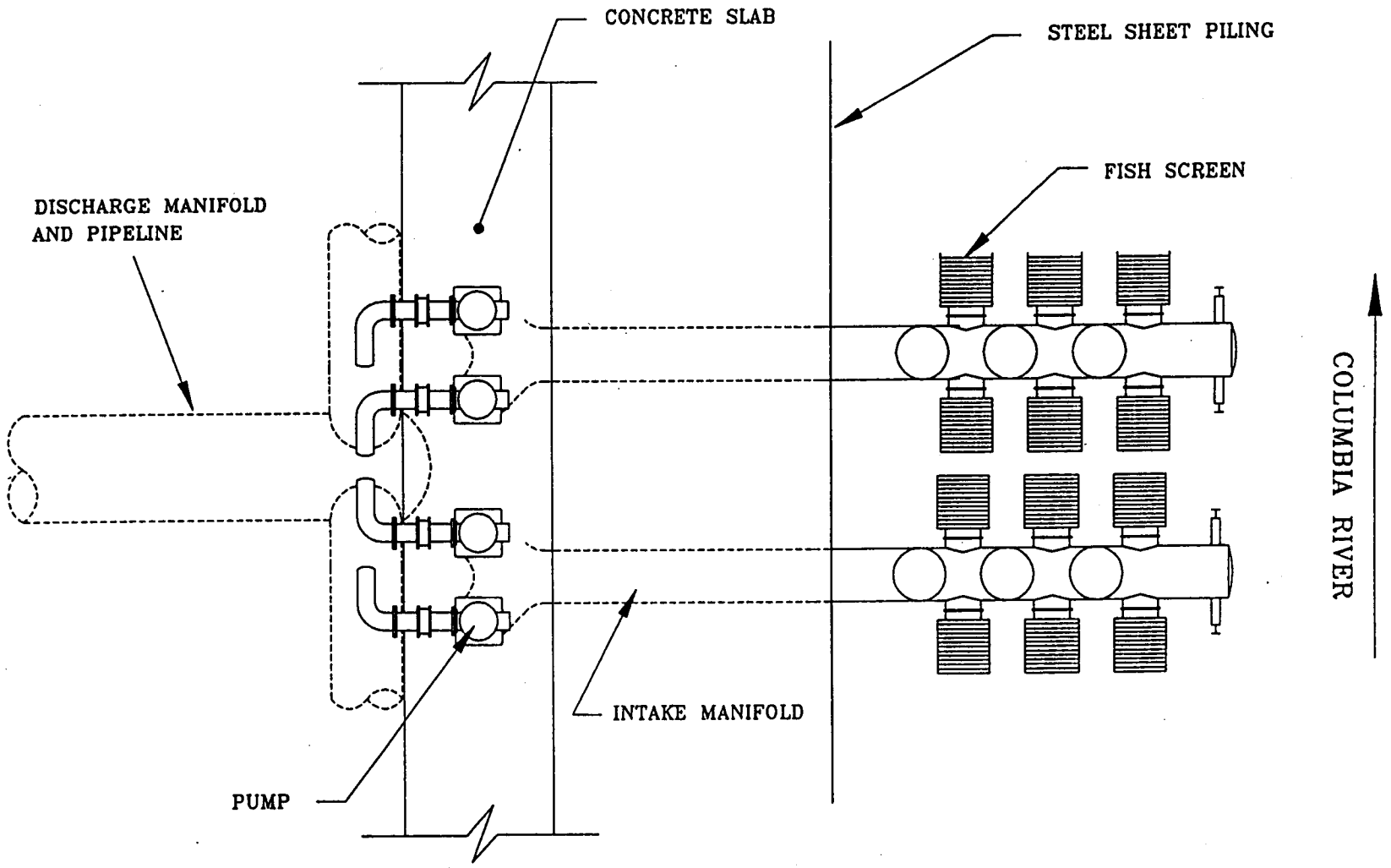


EXHIBIT NO. 8b

PARTIAL PLAN VIEW
COLUMBIA RIVER PUMP STATION

DATE: FEB. 1993	DRAWN BY: W.N.R.	REV.1

FIGURE 6

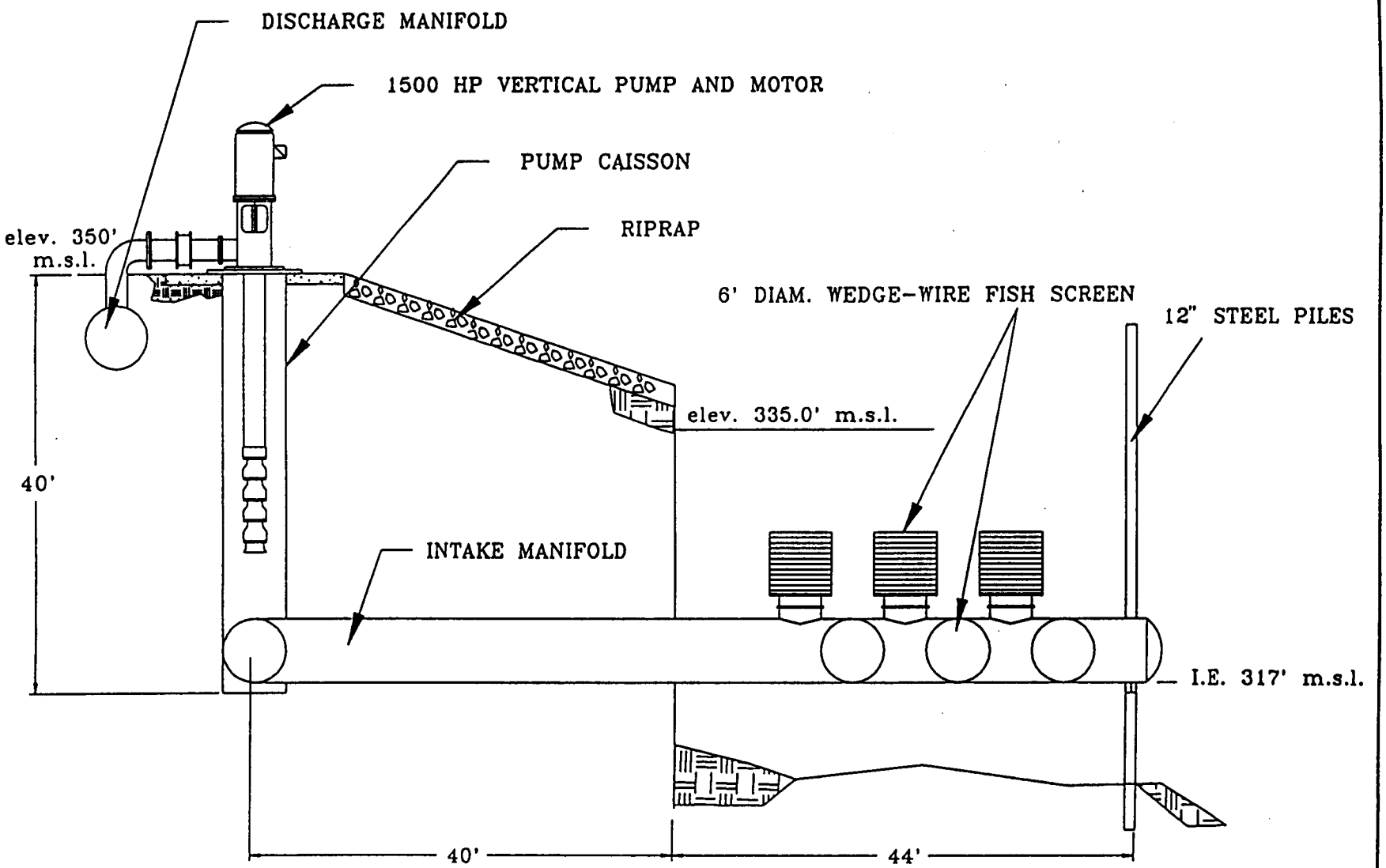
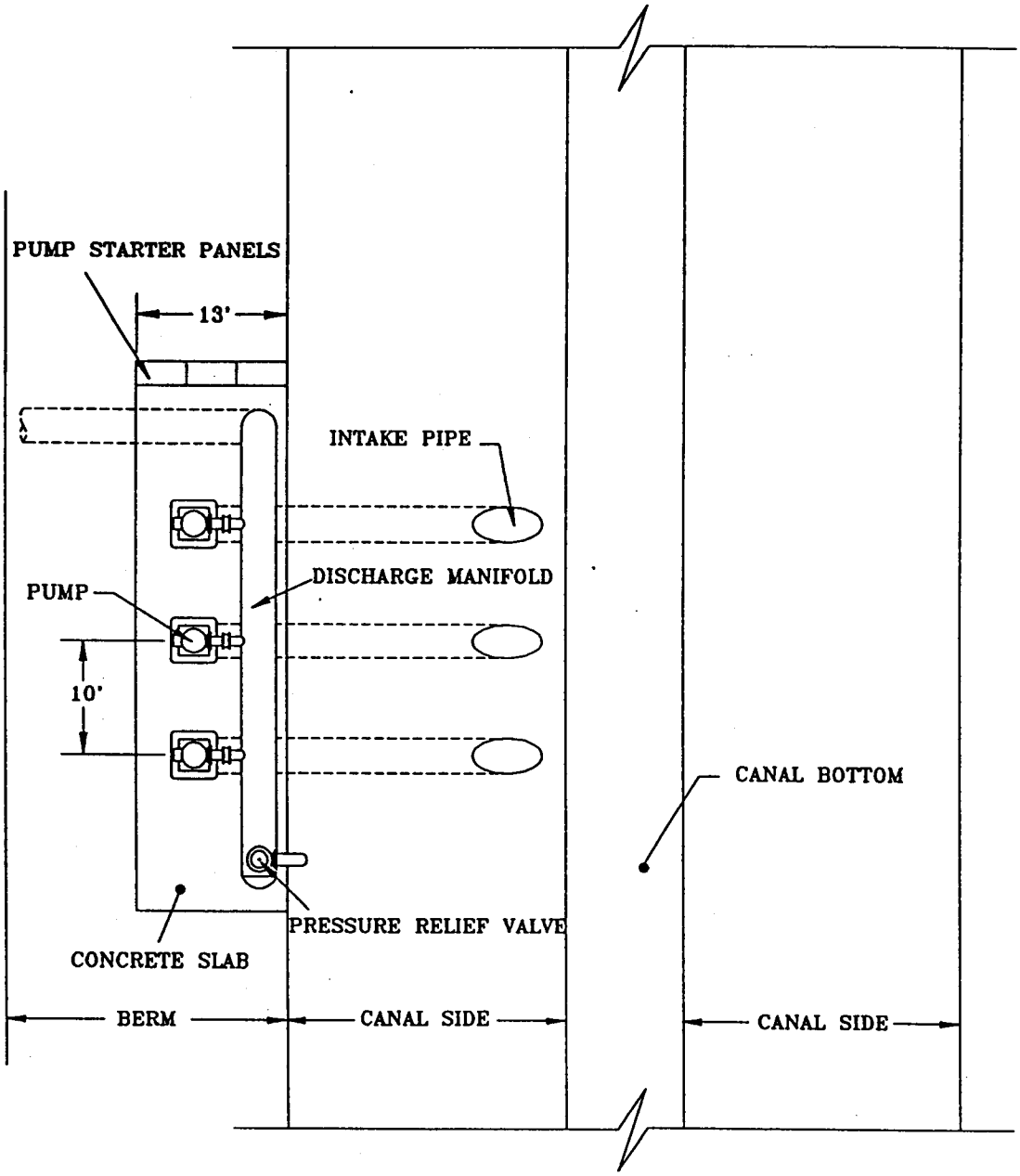


EXHIBIT NO. 8c

TYPICAL CROSS SECTION
COLUMBIA RIVER PUMP STATION

DATE: FEB. 1993	DRAWN BY: W.N.R.	REV. 1

FIGURE 7

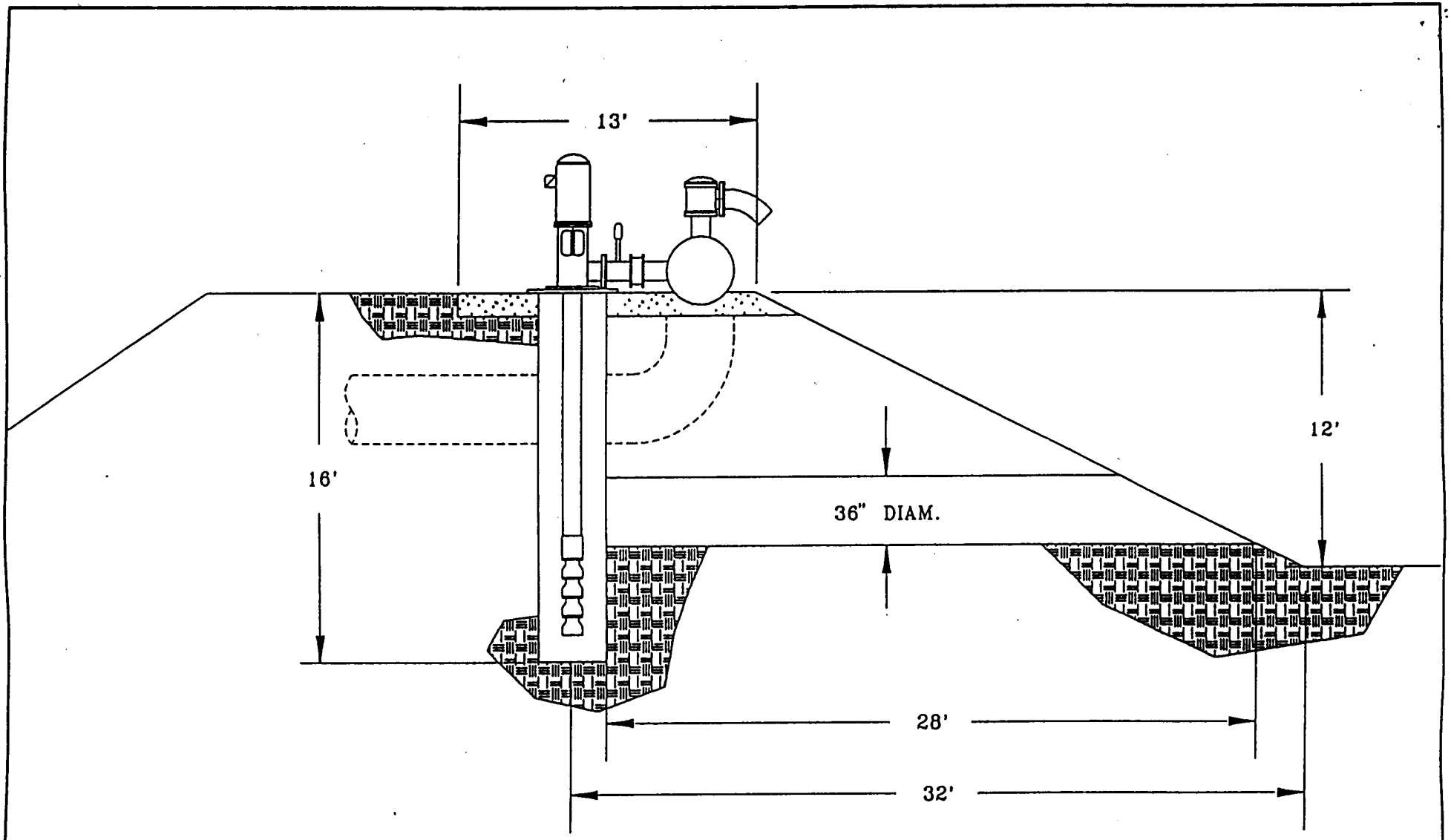


PLAN VIEW EXHIBIT NO. 11a

TYPICAL IRRIGATION PUMP STATION

DATE: FEB. 1993	DRAWN BY: W.N.R.	REV.1

FIGURE 8



CROSS SECTION EXHIBIT NO. 11b

TYPICAL IRRIGATION PUMP STATION

DATE: FEB. 1993	DRAWB BY: W.N.R.	REV.1

FIGURE 9

Plates

1940000 1950000 1960000 1970000 1980000 1990000 2000000 2010000

760000 750000 740000 730000 720000

US Army Corps of Engineers®
Portland District

Goldendale Aluminum

Railroad Island Park

LePage Park

Cliffs Park

John Day Dam

S. Shore Recreation Area

WS (1)

WS (2)

N

Columbia River

John Day River

Albert Philippi Park

Rock Creek Park

215 216 217 218 219 220 221 222 223 224 225 226 227 228 229

T3N R17E W.M.
T3N R18E W.M.
T3N R19E W.M.
T2N R18E W.M.

Key to Features

WS Water Supply

Pumpstations and Utilities

215 River Miles (Corps of Engineers)

Political Boundaries

City Boundary

State Boundary

County Boundary

Corps of Engineers Boundaries

Corps Boundary

Outsite Corps Boundary

Park

Umatilla National Wildlife Refuge

Navigation Channel

Pool Extents

Normal Pool

Spillway Crest at 75k cfs

Natural River at 75k cfs

5000 0 5000 10000 Feet

Projection: State Plane, Oregon North Zone, NAD 27
Pool extents based on Corps of Engineers hydrosurveys, 1994
Produced by GIS, Survey and Mapping Section
US Army Corps of Engineers, Portland District

JOHN DAY DRAWDOWN PHASE I STUDY
Columbia River - Oregon / Washington

IRRIGATION PUMP STATIONS, UTILITIES, AND WATER SUPPLY LOCATION MAP

River Miles 215 - 229

PLATE 1

2010000 2020000 2030000 2040000 2050000 2060000 2070000

760000 750000 740000 730000 720000

US Army Corps of Engineers®
Portland District

N

Harris Farms Pump Station

Roosevelt Park

Rock Creek Park

Arlington

228 229 230 231 232 233 234 235 236 237 238 239 240 241

Columbia River

Key to Features

- WS — Water Supply
- Pumpstations and Utilities
- 215 — River Miles (Corps of Engineers)

Political Boundaries

- City Boundary
- State Boundary
- County Boundary

Corps of Engineers Boundaries

- Corps Boundary
- Outsite Corps Boundary
- Park
- Umatilla National Wildlife Refuge
- Navigation Channel

Pool Extents

- Normal Pool
- Spillway Crest at 75k cfs
- Natural River at 75k cfs

Projection: State Plane, Oregon North Zone, NAD 27
Pool extents based on Corps of Engineers hydrosurveys, 1994
Produced by GIS, Survey and Mapping Section
US Army Corps of Engineers, Portland District

5000 0 5000 10000 Feet

JOHN DAY DRAWDOWN PHASE I STUDY
Columbia River - Oregon / Washington

IRRIGATION PUMP STATIONS, UTILITIES, AND WATER SUPPLY LOCATION MAP

River Miles 228 - 242

PLATE 2

Key to Features

WS — Water Supply

Pumpstations and Utilities

215 — River Miles (Corps of Engineers)

Political Boundaries

- City Boundary
- State Boundary
- County Boundary

Corps of Engineers Boundaries

- Corps Boundary
- Outsite Corps Boundary
- Park
- Umatilla National Wildlife Refuge
- Navigation Channel

Pool Extents

- Normal Pool
- Spillway Crest at 75k cfs
- Natural River at 75k cfs

Projection: State Plane, Oregon North Zone, NAD 27
Pool extents based on Corps of Engineers hydrosurveys, 1994
Produced by GIS, Survey and Mapping Section
US Army Corps of Engineers, Portland District

US Army Corps of Engineers®
Portland District

Columbia River

Quesnel Park

Roosevelt Park

Arlington

N. Roosevelt WS (2165)

WS (3,4)

Boeing/Taggares, Harris, and Sullivan Farms Pump Stations

N

5000 0 5000 10000 Feet

JOHN DAY DRAWDOWN PHASE I STUDY
Columbia River - Oregon / Washington

IRRIGATION PUMP STATIONS, UTILITIES, AND WATER SUPPLY LOCATION MAP

River Miles 241 - 256

PLATE 3

Key to Features

WS — Water Supply

Pumpstations and Utilities

215 — River Miles (Corps of Engineers)

Political Boundaries

- City Boundary
- State Boundary
- County Boundary

Corps of Engineers Boundaries

- Corps Boundary
- Outsite Corps Boundary
- Park
- Umatilla National Wildlife Refuge
- Navigation Channel

Pool Extents

- Normal Pool
- Spillway Crest at 75k cfs
- Natural River at 75k cfs

Projection: State Plane, Oregon North Zone, NAD 27
Pool extents based on Corps of Engineers hydrosurveys, 1994
Produced by GIS, Survey and Mapping Section
US Army Corps of Engineers, Portland District

US Army Corps of Engineers®
Portland District

Mercer Ranch Pump Station
WS (11)
100 Circles Pump Station
USFWS Whitcomb Island Pump Station
WS (CH2M-12)
Crow Butte Park
Columbia River
Quesnel Park
Boardman
WS Or. St. Hwy. Dept. (9)
Circle C Pump Station

254 255 256 257 258 259 260 261 262 263 264 265 266 267 268

N

5000 0 5000 10000 Feet

JOHN DAY DRAWDOWN PHASE I STUDY
Columbia River - Oregon / Washington

IRRIGATION PUMP STATIONS, UTILITIES, AND WATER SUPPLY LOCATION MAP

River Miles 254 - 268

PLATE 4

2130000 2140000 2150000 2160000 2170000 2180000 2190000 2200000

770000 780000 790000 800000 810000

Key to Features

- Water Supply (WS)
- Pumpstations and Utilities
- River Miles (Corps of Engineers) (215)

Political Boundaries

- City Boundary
- State Boundary
- County Boundary

Corps of Engineers Boundaries

- Corps Boundary
- Outsite Corps Boundary
- Park
- Umatilla National Wildlife Refuge
- Navigation Channel

Pool Extents

- Normal Pool
- Spillway Crest at 75k cfs
- Natural River at 75k cfs

Projection: State Plane, Oregon North Zone, NAD 27
Pool extents based on Corps of Engineers hydrosurveys, 1994
Produced by GIS, Survey and Mapping Section
US Army Corps of Engineers, Portland District

US Army Corps of Engineers
Portland District

N

South Slope Irrigation District

Stimson and Sunhaven Pump Stations

Milliman Farms Pump Station

Sandpiper Farms Pump Station

USFWS Whitcomb Island Pump Station

WS (CH2M-12)

WS (Various)

Irrigon

Columbia River

Umatilla NWR, WS (CH2M-6,7,8,9,10,11,46)

Umatilla / Irrigon Fish Hatchery

West Empire Pump St. #2 and West Extenstion Irrigation District #2

West Empire Pump Station #2

E. Oregon Farming Co. and Columbia Improvement District

WS (Carlson Sumps) and Port of Morrow Pump Stations

Port of Morrow Pump Stations

WS #1, #2, 2156)

WS (18)

Boardman Park

Boardman

WS Or. St. Hwy. Dept. (9)

Circle C Pump Station

T5N R26E WM

T5N R24E WM

T4N R24E WM

T5N R25E WM

T4N R25E WM

5000 0 5000 10000 Feet

JOHN DAY DRAWDOWN PHASE I STUDY
Columbia River - Oregon / Washington

IRRIGATION PUMP STATIONS, UTILITIES, AND WATER SUPPLY LOCATION MAP

River Miles 265 - 281

PLATE 5

Key to Features

Water Supply (WS)

Pumpstations and Utilities

River Miles (Corps of Engineers) (215)

Political Boundaries
- City Boundary
- State Boundary
- County Boundary

Corps of Engineers Boundaries
- Corps Boundary
- Outsite Corps Boundary
- Park
- Umatilla National Wildlife Refuge
- Navigation Channel

Pool Extents
- Normal Pool
- Spillway Crest at 75k cfs
- Natural River at 75k cfs

Projection: State Plane, Oregon North Zone, NAD 27
Pool extents based on Corps of Engineers hydrosurveys, 1994
Produced by GIS, Survey and Mapping Section
US Army Corps of Engineers, Portland District

N

US Army Corps of Engineers®
Portland District

2240000 2250000 2260000 2270000 2280000 2290000 2300000 2310000

850000 840000 830000 820000 810000

William Gas Pipeline-West Crossing

Agri-Northwest Pump Station

WS (2157,2158,2163)

Umatilla Sewer Outfall

McNary Dam

Plymouth Park

Wanahla Marina Park

Columbia River

278 279 280 281 282 284 285 286 287 288 289 290 291 292

Irrigon Park

Irrigon

WS (48,49,50)

WS (47)

WS (Various)

Umatilla / Irrigon Fish Hatchery

West Empire Pump Station #2 and West Extension Irrigation District #2

Strebin Farms Pump Station

Perkins Farm and C & B Livestock Pump Stations

West Extension Irrigation District Pump Station

Leonard Pump Station

Umatilla High School

Umatilla

WS

T5N R27E WM

T5N R28E WM

5000 0 5000 10000 Feet

JOHN DAY DRAWDOWN PHASE I STUDY
Columbia River - Oregon / Washington

IRRIGATION PUMP STATIONS, UTILITIES, AND WATER SUPPLY LOCATION MAP

River Miles 278 - 292

PLATE 6